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ANNUAL REVIEW OF NEW ENGLAND BUSINESS:

Stability at High Levels

Relative stability at high levels characterized New England business activity during 1956. In the recovery year of 1955, rapidly expanding business established new records of performance. During 1956 most of those records were maintained and some surpassed.

Moreover, the increasing diversification of New England industry in recent years has paid off. No longer is the region's prosperity so vulnerable to weakness in a dominating industry. There were weakening influences in the national economy during 1956 – the steel strike, slower sales of automobiles and farm equipment – to name a few. But none of these had a strong impact in New England. Even the much publicized decline in new housing activity did not materialize in the region.

Although the New England economy experienced relatively little effect from these retarding influences, it participated in the vigorous nation-wide surge in business capital investment. Desires of business to enlarge and modernize plant and equipment made strong demands upon limited supplies of labor, basic com-

(Continued on page 2)

Also **New Peaks in Consumer Spending and Saving,** *Page 6.*
Manufacturing Indexes—New England and Massachusetts: New Tools for Analysis, *Page 8.*

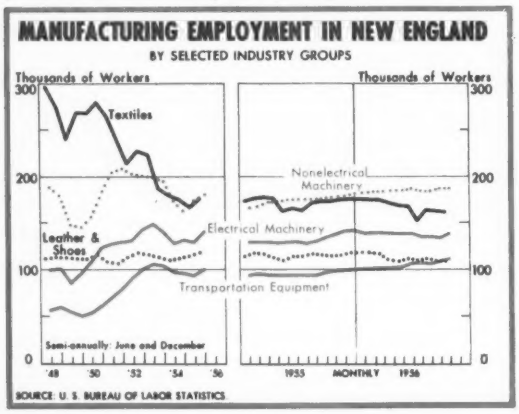
modities and funds. In consequence, the high level of business activity during the year was attended by considerable upward pressure upon wage scales, commodity prices and money rates. Credit volume expanded considerably, but not far or fast enough to satisfy the surging wants of all borrowers.

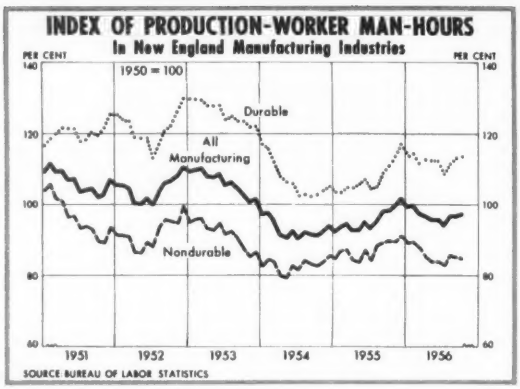
Physical volume of **production** at the region's factories, as measured by this bank's New England Manufacturing Index, was historically high during last year. The seasonally adjusted index for each month of 1956 through November exceeded the index for the corresponding month of 1955 as well as the average index value for the earlier peak year of 1953. The index pursued a generally upward trend through 1955 and early 1956 to a peak value of 125 in April, based on a base period of 1950-2 equalling 100. Since April the course of the index has been generally downward to a November value of 117 which still exceeds the year earlier index value of 116. Of the four component industry indexes now available, those for textiles, paper and primary metals also show irregular declines from April peaks, while that for leather products shows a decline from November 1955.

A total of 7,991 **new businesses** were incorporated in the six New England states during the first 11 months of 1956, an increase of 4.8 per cent from the comparable period of 1955. New England business failures declined 9.7 per cent in number in these comparable 11-month periods, in marked contrast to the national trend.

Freight carloadings originating on New England railroads experienced a net decline of 1.2 per cent between 11-month periods of 1955 and 1956. Monthly **electrical energy** production in the region consistently exceeded year-ago levels.

A favorable flow of **orders** to manufacturers supported the high level of production during most of the year, with a temporary lull at midyear, renewed strength in early fall, and some





further easing in November. **Inventory** positions appeared to be moderately rising, and there was occasional evidence of accumulation of metals, machinery and other durables in anticipation of possible shortages.

Employment conditions greatly benefited from this favorable business atmosphere. Total nonfarm employment in New England registered a generally upward trend during the year. It maintained a comfortable margin over comparable 1955 figures for each month through October. Greatest gains were in nonmanufacturing employment, with impressive strength in construction and trade. Among durable-goods manufacturing industries, only ordnance failed to maintain 1955 levels of employment. Nondurable-goods manufacturing sustained worker forces above 1955 levels until midyear, when reduced operations in the textile and leather products contributed to some cutbacks in employment.

Employment strength has been correlated with a low level of **unemployment.** Total insured unemployment in New England declined 37 per cent from January to October, while initial claims for insurance benefits declined 25 per cent over the same period. Some increase in claims developed in textile mill cities during later months of the year. Many industries, however, have sensed a shortage of adequate labor for their expanded operations.

Average weekly **earnings** of factory production workers reached new peaks in 1956 largely through increases in wage rates and increased employment opportunities in the higher wage durable goods industries. Average hourly earnings in nearly all industries advanced but cutbacks in overtime from year-ago levels resulted in lower weekly earnings for some workers, particularly in the primary metals and textile industries. Average weekly hours have been under year-ago levels in much of the region since spring.

The index of **man-hours** worked by production

workers in New England manufacturing industries was above year-earlier levels in each month from April 1955 through August of last year. In September and October the index was slightly lower than the levels in 1955 mainly because of reduced employment and hours worked in nondurable-goods industries. The index for the durable-goods industries has exceeded year-earlier levels in each month since June 1955 with an upward trend in progress since August of last year. However, the year-to-year gains have not been so substantial as earlier.

The unusual stability of **prices** which had prevailed in recent years gave way during 1956 to more frequent and extensive price advances. Industrial commodity prices had already manifested a rising tendency during the last half of 1955. They continued that movement except for a brief interlude during the early summer months of 1956. They were joined during the first half of 1956 by rising prices for farm products and processed foods, a sharp reversal from the generally downward course of such prices since early 1951. November wholesale prices were higher than a year ago by 4.0 per cent for industrial commodities, 4.5 per cent for farm products, and 4.9 per cent for processed foods. While price advances have been widespread, some price weaknesses have developed, such as for lumber, copper, synthetic fibers and household appliances.

Consumer prices broke from their stable level in May, and by November were 2.4 per cent higher than a year earlier.

Retail trade in New England seems to have attained a new dollar volume record last year, in spite of a markedly lower sales volume for automobiles than in the record 1955 year. Sales of most other consumer-durable goods and soft goods have been sustained in good volume. New England department stores have accumulated a comparative gain of about three per cent in sales over 1955. Relative gains are reported for most departments, although sales of men's and boys' wear have been slow, while those of housefurnishings have declined somewhat from the high levels reached in earlier months. Over-all sales were adversely affected by poor shopping weather early in the year, but easily overcame this handicap in subsequent months. Some relative slowness in sales appeared in the early Christmas shopping season.

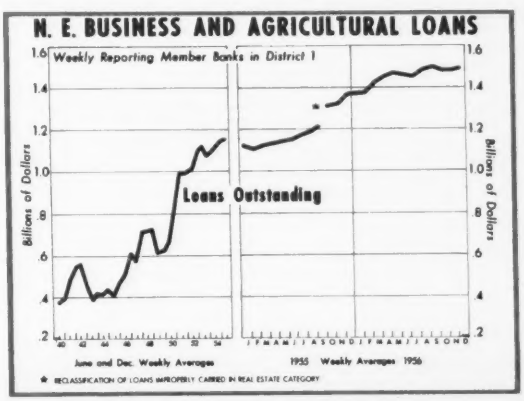
Consumer credit continues to increase. At department stores, instalment sales have gained relative to total sales. Collection experience remained generally satisfactory. At New England financial institutions outstanding balances of consumer credit at the end of October were 16 per cent greater than a year earlier. Repayments exceeded new extensions only in September. Collection ratios have fluctuated closely around those of 1955.

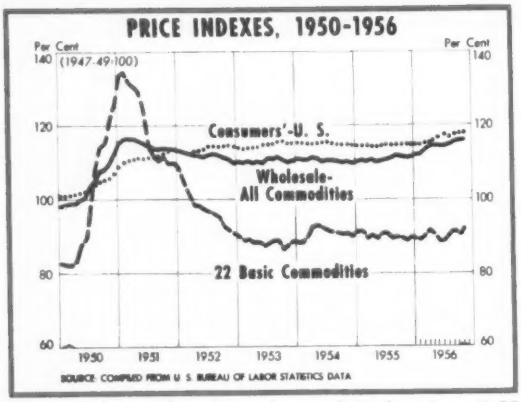
The outstanding volume of **business loans** at New England commercial banks increased sharply during the first quarter of 1956, contrary to custom. Since March the increase has been moderate, but at the September peak the outstanding volume was 24 per cent greater than a year earlier. Reductions on loans to sales finance companies in recent months have approximately balanced seasonal increases to other borrowing groups.

Further expansion in **mortgage credit** has been limited by the availability of funds. Savings inflows to savings institutions have been at a lower rate than a year ago, and some lending institutions have found their ratios of mortgage loans to savings funds close to legal or self-imposed limits. Many lenders have raised interest rates and down payment requirements on conventional type mortgages, and have curtailed commitments for the purchase of out-of-state VA and FHA type mortgages.

In view of continuing strong demands for credit at a time when resources were already intensively employed, **monetary policy** in the nation continued to be restrictive, a course begun in 1955. Federal Reserve discount rates were raised twice during the year to reach three per cent. Other interest rates also rose, with those on prime business loans being raised twice by leading banks to reach four per cent. U. S. Treasury, state and municipal, and corporate security yields surpassed previous postwar highs reached in 1953.

Although New Englanders did not save at quite as strong a rate in 1956 as in 1955, new records were set in total **savings.** Mutual savings bank deposit balances in the area increased at a rate of seven per cent in the year. Life insurance sales here were 14 per cent greater than a year





ago. Sales and redemptions of Series E and H Savings Bonds in New England were at about the same level as last year, with redemptions still exceeding sales. Increased competition for savings was marked by higher yields on savings deposits. Beginning in January 1957, the maximum rate commercial member banks may pay on time deposits was raised to three per cent from the 2½ per cent rate which had been in effect since September 1935.

New England **agriculture** derives about 70 per cent of its $720,000,000 income from dairy and poultry activities. In 1956 the farm price of milk averaged below 1955 levels during the first quarter, but has been at or above year-ago levels since April. Costs of production have risen, however, so that net incomes are estimated to have been only slightly above 1955 levels. Presently, costs of production have been pushed upward again temporarily because of sparse fall pastures and a small, poor quality hay and silage crop.

Broiler prices hovered at or below cost of production for a long period in 1956. During the last quarter they were consistently below cost of production for even the most efficient producers. Overproduction was the major problem—often ranging to 20 per cent above 1955 levels. Prices are not expected to improve markedly until March.

Egg production in 1956 set a new record nationally. New England production was also high with prices somewhat below year-ago levels.

Fish landings in 1956 at New England ports were about three per cent less than in 1955. Increasing competition has come from low-cost imports of fresh and frozen groundfish fillets. Increased tariff protection has been denied, but improved credit facilities have been made available for care of the fleet and for more orderly marketing of products.

New England **construction** activity appeared to attain a new record in 1956 under the impelling demand for more and improved industrial buildings, stores, homes, roads, schools and other facilities. F. W. Dodge Corporation reported a 12 per cent increase in the total value of contract awards in the region for comparable 11-month periods of 1955 and 1956, including a 13 per cent increase for nonresidential buildings and a 21 per cent increase for residential buildings. These gains were accompanied by increasing costs of construction and difficulties in financing.

New England **resort** business in 1956 was again large if not fully satisfying to all operators. Skiing guest occupancies during the winter season were reported to be about equal to those of the preceding season, and would have been appreciably more but for a prolonged January thaw and heavy March storms which kept many skiers closer to home. Summer guest business was relatively good in June and August, but poorer in the other months. Occupancies for the season exceeded those of the 1955 season by about one per cent.

Durable-Goods Manufacturing

The **electrical-equipment** industry, particularly the electronics branch, continued to be a main source of growth in the regional economy. Recent expansions provided greater employment stability in the Lawrence-Haverhill area. Substantial government contracts enabled reutilization of former textile mill space in other communities. Activity was brisk at plants producing such items as transformers, tubes, fuses, phonographs and lamps.

Some segments of the **nonelectrical machinery** experienced a tapering down in activity from the higher levels that prevailed in earlier months of the year. Foundries producing for textile machinery reported spottier work schedules. Paper mill machinery makers had a busy year. The flow of orders to machine tool producers, huge in earlier months of the year, eased somewhat since late spring, but a large backlog of orders assures busy production schedules for months to come.

Diverse situations confronted New England's producers of **primary and fabricated metals.** Blast furnace activity was busily directed towards the rebuilding of depleted pig iron inventories. Foundry operations in general were spotty, but with busy schedules for pipe producers. Open hearth steel operations eased somewhat in the fall as the market for nails, wire, screw machine and other products subsided. Electric steel operations were plagued by mounting prices of steel scrap. Lessened demand for copper and brass products during much of the year retarded operations at such plants.

In the field of **transportation equipment,** the Connecticut aircraft industry continued to be a leader in providing for employment expansion. Employment at automobile assembly plants suffered during much of the year from curtailed factory production, and more recently from interruptions due to model change-overs. Shipbuilding activities increased as work progressed on construction of tankers, destroyers and other vessels. Prospects of further order receipts are related to long range plans for meeting the Suez Canal problems.

Employment in the **lumber** industry was considerably higher in 1956 than 1955. Prices of the better quality pine, birch and maple lumber moved upward during the year, although prices of hardwood flooring dropped and prices of many of the lower grades of lumber remained constant or decreased.

Employment in the New England **furniture** industry showed but little change despite a slight sag last fall because of one large strike. In general, there was full utilization of available productive resources within the industry throughout the year. Demand for production remains very high. Currently order backlogs are slightly smaller than they were six months ago, but probably larger than a year ago. The industry is forced to compete with aggressive competition from the South.

Nondurable-Goods Industries

The New England **textile** industry lost further ground during 1956 with more mill closings. October employment was nearly 12,000 less than a year ago. Most segments of the industry suffered from slackened demand. Cotton and synthetic mills and finishing plants were especially hard hit. However, by late fall an air of optimism was developing in the industry. It was hoped that New England mills would benefit from announced increases in prices for their products, wage increases recently granted by Southern producers, limitation of fabric and apparel imports from Japan, and the increased tariff on imported wool cloth. The New England Manufacturing Index for textile products is computed at 76 for November, compared with 86 a year ago.

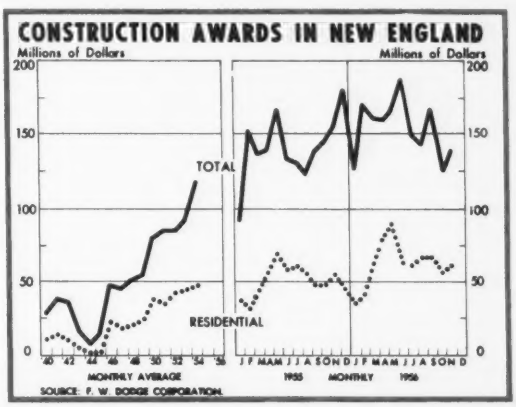
Employment in the **apparel** industry has exceeded year-ago levels since August. Operations, except at some outerwear plants, were either maintained or expanded. While 1956 business compared favorably with that of 1955, in some lines reorders were below expectations and orders on hand for spring merchandise were lower, due in part to the lateness of Easter in 1957. Rising fabric prices and hikes in other costs forecast higher prices for spring clothes.

New England **shoe** plants set new production records in 1956. During the first 11 months of the year the region's shoe production was 1.6 per cent ahead of a year ago. Orders placed by retailers for spring lines were not as large as a year ago, due in part to the late date of Easter. November inventories of both manufacturers and retailers were estimated at near normal levels. Prices advanced over the year but no further increases are expected at retail on spring shoes. The November New England Manufacturing Index for leather products is 112, compared with 124 for a year earlier.

The costume **jewelry** industry had a good year in 1956. Employment exceeded the 1955 level in each month except February, but workweeks were shorter. Some manufacturers report sales well above 1955 levels but others did not fare as well. Price competition was keen. Industry spokesmen feel that low cost foreign imports cut into the domestic market.

Production of New England **rubber** products was well above the year-ago level during the early months of 1956. However, the employment trend was downward to July and employment gains during the second half of the year lagged behind those of a year ago. Rising material, labor, and other costs resulted in price increases for a wide range of rubber products.

According to the New England Manufacturing Index for the **pulp and paper industry,** production for the industry was 7.8 per cent higher in the first 11 months of 1956 than for corresponding months of 1955. Producers of some grades of paper had large backlogs of orders during most of the year, but there was some reduction in backlogs towards the end of the year. Expanding plant capacity may be bringing about a closer balance between supply and demand.



New Peaks in Consumer Spending and Saving

New Englanders set new records in consumption expenditures during 1956. Expanded employment and higher wage rates made this possible even as liquid savings increased. Retail sales in New England during the first ten months of 1956 were an estimated four per cent higher than during the same period a year ago. Consumer credit played an important role in supporting the high level of sales but did not expand as rapidly as in 1955. Per capita liquid savings of New Englanders reached record levels in 1956, about 4.4 per cent above those in 1955.

Automobile Sales Lag, Others Gain

Sales of new automobiles in New England lagged 15 per cent behind those of a year ago during the first ten months of 1956. But sales of other consumer durables and of soft goods more than offset these losses. The result was a new record level of total retail sales.

New car registrations exceeded those of a year ago only in February. In spite of the poor comparative performance with the record year 1955, registrations for the ten-month period of 1956 were larger than for any other year except 1950.

Department stores in New England bettered even their 1955 record sales performance. For the first ten months of 1956, sales increased three per cent above the same period a year ago. All major departments of these stores made gains except the Men's and Boys' Wear Department. Sales in this department were about one per cent smaller than a year ago. The department achieving the largest gain for the period was the Miscellaneous Merchandise Department, which sells such items as toys, luggage, candy, sporting goods and cameras. A ten per cent gain in sales of sporting goods and cameras sparked the departmental gain of five per cent. Homefurnishings Department sales for the ten months were more than three per cent above year-ago levels, largely as a result of strong sales in the first half of the year. Since then sales have shown only small gains from year-earlier levels. Sales increases for television, radios, phonographs, records, etc., were larger than those for major appliances.

Sales of Women's and Misses' Apparel and Accessories Departments exceeded the 1955 level by about two per cent largely due to strength in the latter part of the ten-month period. Larger gains in these departments occurred in sales of coats, furs, millinery, gloves, neckwear and women's shoes. Sales of the Small Wares Department, consisting of notions, toilet articles and drugs, silverware and jewelry, umbrellas, and books and stationery, rose three per cent. Sales of these items were strongest in the first half of the year. Sales of the Piece Goods and Household Textiles Departments were one per cent larger than a year ago. Basement Store sales gains nearly equalled those made in the Main Store. In contrast to main store behavior basement sales of men's and boys' clothing increased in 1956.

Continued Expansion in Volume of Consumer Credit

Consumer credit outstanding at New England's financial institutions increased steadily during the first ten months of 1956 but at a slightly slower pace than during the similar period of 1955. At the end of October, the volume outstanding was 16 per cent greater than a year earlier. In the previous 12 months the gain was 17 per cent.

Consumer credit extended by these institutions exceeded year-ago figures each month except March and September. For the ten months, the volume extended exceeded that of the like period last year by 13 per cent. At the end of October 1955, the gain had been 21 per cent. The monthly volume extended between January and October 1956 exceeded the volume repaid every month except September. Repayments exceeded year-ago levels each month of 1956 but the ratio of repayments to the volume outstanding has fluctuated around 1955's ratios. The ratio for October 1956 was slightly higher than it was a year earlier.

Instalment sales at department stores showed larger year-to-year gains nearly every month than did sales of other types. The popularity of revolving credit accounts was partly responsible.

The amounts outstanding for both charge and instalment accounts were above year-ago levels: two per cent for charge and six per cent for instalment accounts. Collection ratios on charge accounts in some recent months lagged slightly behind those last year but in October were slightly higher. On instalment accounts, collection ratios equalled or exceeded those in 1955.

Liquid Savings Continue to Rise

The savings picture in New England remained bright during 1956, although there was no change in the over-all growth rate from last year. During the first six months of 1956, New Englanders increased their fund of liquid savings by about $570 million compared with $535 million in the like period a year earlier.[1] Liquid savings in New England totaled about $19.5 billion at mid-1956, showing a 12-month growth of $1 billion.

The growth in the volume of savings in New England from the end of 1955 to mid-1956 was 3.0 per cent, whereas in the United States it was 3.9 per cent. The national growth reflects a greater population increase than New England has experienced. The increase in selected liquid savings per person in New England totaled $41, compared with an increase of $28 for the country as a whole.

Liquid savings per person in New England rose from $1,988 at the end of 1955 to about $2,029 by mid-1956. They are expected to reach $2,076 by the end of the year if the savings rate of the first half continues. Nationally, per capita savings increased from $1,356 at the end of 1955 to $1,384 at mid-1956. Present indications point to a total of about $1,423 at year's end.

Savings accounts remain New Englanders' preferred form of saving. Mutual savings bank deposits make up 65 per cent of these savings. The remainder is divided about equally between time deposits at commercial banks and shares in savings and loan associations and cooperative banks.

Per capita deposits at mutual savings banks in New England reached $806 at the end of June 1956, compared with $782 at the end of 1955. Time deposits at commercial banks amounted to $216 at mid-1956, up slightly from $215 at the end of 1955.

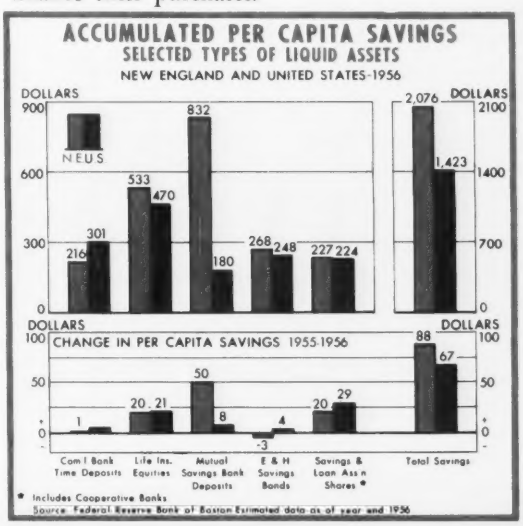
Nationally, savings accounts also rank first in dollar volume, but are quite closely followed by life insurance equities. Commercial bank time deposits and shares in savings and loan associations account for most of this segment of savings since mutual savings banks do not operate in 31 of the states. Per capita holdings of time deposits were $299 at mid-1956, compared with $296 at the end of 1955.

Share accounts at savings and loan associations and cooperative banks have shown the fastest rate of growth of any of the savings media both nationally and in New England. By mid-1956 per capita holdings were $209 in the United States and $216 in New England, compared with $195 and $207 respectively at the end of 1955.

Equities of life insurance policyholders comprise the second largest share of savings in the nation and the region. In New England per capita equities amounted to $522 by mid-1956, compared with $513 at the close of 1955. For the nation they were $456 by mid-year, up from $449 at the end of 1955.

Series E and H United States savings bonds are third in savings preference for both New Englanders and the nation. By the end of June 1956 per capita holdings were $269 in New England, down from $271 at the end of the previous year. Nationally, they rose $1 to $245 at mid-year. Redemptions of Series E bonds continue to exceed sales in New England at about the same rate as a year ago. Sales have exceeded redemptions in the country as a whole. But the excess has been much smaller this year than in 1955.

Spending by New Englanders will probably set a new record this year, with lagging sales of automobiles being more than offset by sales of other consumer goods. Nonetheless, the region's people added to their holdings of liquid savings. They also continued their active use of credit to finance their purchases.



1. Liquid savings, as used in this article, include deposits in mutual savings banks, time deposits in commercial banks, savings capital in savings & loan associations and cooperative banks, E and H United States savings bonds, and life insurance equities. Postal savings deposits, included in this series through 1953, have been omitted.

Manufacturing Indexes—New England and Massachusetts

NEW TOOLS FOR ANALYSIS

In performance of their assigned roles in guiding the region's monetary system and in formulating national monetary policy, directors and officers of the Federal Reserve Bank of Boston must base their actions on the most current, accurate and comprehensive data available. A significant gap in the available information has been the lack of any seasonally adjusted monthly series of output by industry. Especially needed was information that would be directly comparable with the manufacturing indexes prepared by various agencies for the United States.

Manufacturing activity accounts directly for about a third of New England's income. Even more important, however, manufacturing is a basic income-generating activity. It supports the related services of transportation, trade, finance, communications, construction, and allied activities. If manufacturing in the region shows persistent strength, it will support the expansion of dependent activities. Trends in manufacturing therefore are of basic importance in determining trends in total economic activity in a region such as New England.

New England accounts for less than 40 cents of each hundred dollars of United States mineral output. Wages paid to miners account for about 2.5 per cent of wage and salary payments in the United States but only two-tenths of one per cent of the New England counterpart. Clearly the trends in mineral output in New England have a negligible effect in comparison with trends in manufacturing. For this reason, an index of manufacturing for New England is for most practical purposes comparable with the United States index of industrial production prepared by the Federal Reserve Board.

Availability of manufacturing indexes on a regional basis would also serve the needs of many banks, state agencies, and private groups who maintain a continuing analysis of the region's economy. The usefulness of these data would be even greater if comparable indexes for each New England state could also be provided.

Developing the Indexes — Sponsors

In October, 1953, Professor Harry Ernst, at that time a graduate student at Harvard University, was employed as a consultant by the Massachusetts Department of Commerce to work on preparation of an industrial production index for Massachusetts. The technique he developed, while simple in concept, promised to be very difficult to carry to completion. In the spring of 1954, the Federal Reserve Bank of Boston awarded Professor Ernst the first of several research contracts to explore and then to develop his technique into a full scale index of manufacturing for New England.

In June, 1955, Professor Ernst became Director of the Institute for Economic Research at Tufts University. Work on both the Massachusetts index and the New England index has been carried on at the Institute, with financial support from the Federal Reserve Bank of Boston, the Massachusetts Department of Commerce, and Tufts University.

Development of the index has been assisted by the staff of the Research Department of the Federal Reserve Bank of Boston. Calculation of the current index material is carried on by the Research Department. Both the Massachusetts and New England indexes, together with data for other states when developed, will be prepared and published by the Reserve Bank.

Professor Ernst's technique involves estimating equations prepared by use of data supplied by more than 600 manufacturing firms representing all the various industries in Massachusetts and New England. To these firms goes credit for a spirit of public interest which motivated them to supply data from their own records. Without their splendid response to requests by the Reserve Bank, these indexes would be impossible.

Current data used in estimating New England industrial output are provided from three main sources. State agencies who cooperate with the Bureau of Labor Statistics in collecting employment information went to considerable effort to reclassify some of their data. As a result, they are able to supply to the regional office of the Bureau of Labor Statistics current monthly estimates of man-hours of labor devoted to each major industry in their states. These monthly data are collected by the regional office and supplied to the Reserve Bank for use in calculating the index.

The second type of information used in estimating output is the consumption of kilowatt hours of electricity by industry in the various New England states. These data are prepared by 24 electric utility companies which have cooperated by preparation of a sample of approximately 3,400 firms to represent specified industries. Power consumption of those firms is reported monthly to the Statistical Committee of

the Electric Council of New England which supplies the data to the Federal Reserve Bank. Here again, the entire project was made possible only through the public interest of the utilities who have accepted the responsibility to report as part of the monthly collection procedure.

In addition, 123 industrial firms which generate their own electricity supply data. Some of these firms report directly to the Federal Reserve Bank. Others report through the Massachusetts Department of Commerce where their reports were first assembled in preparation for publication of the index. Their cooperativeness has been an important asset.

In the testing and planning of the indexes, the assistance, advice, and guidance of the staffs of the Massachusetts Department of Labor and Industries, the Massachusetts Department of Commerce, the Regional Office of the Bureau of Labor Statistics, and the Electric Council of New England have been of critical importance. Their work has enabled Professor Ernst to develop his concept into a working, useful tool of analysis.

Basic Formulation of the Index

The basic concept employed in preparing the index is that manufacturing output depends on the number of man-hours worked by production workers and their output per man-hour.[1] General dependence of output on use of labor as measured by man-hours has been clearly demonstrated. Use of this relationship in estimating output is the fundamental strength of the technique used.

The use of output per man-hour as one of the variables determining production involves the difficult practical problems of its current measurement. Since it can be measured directly only after actual manufacturing output is known, it has to be estimated in some other manner to obtain current data. One method is to project past trends to the present, but this technique involves error because output per man-hour does not always change in a smooth trend.

In the New England production index, output per man-hour changes are linked to changes in use of kilowatts of electricity per man-hour. It assumes that each man-hour yields a greater output on the average as more electrical power is used in the productive process. This assumption is reasonable in theory and has proven accurate enough when tested on the basis of past experience. Addition of more or better machines generally results in increased use of electrical power. Similarly as output shifts from less productive to more productive plants, the shift results in greater average use of electricity.

In addition to providing a measure of changes in output per man-hour, the use of kilowatts in estimating manufacturing output has practical statistical advantages. A production index based entirely on man-hours reflects all erratic movements to which any statistical series is subject. By including kilowatt hours in the output estimate, erratic fluctuations are reduced.

Derivation of Estimating Equations

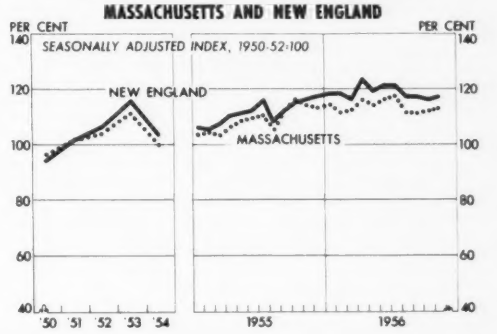
Manufacturing production in the various industries included in the New England Manufacturing Index was estimated through two steps. First, output per man-hour was derived by use of an estimating equation. Then this man-hour output was multiplied by the number of man-hours in the industry to arrive at total monthly production.

Equations for estimating output per man-hour were derived by statistical correlation. Annual data on man-hours, kilowatt hours, and production for the years 1950-1954 were obtained from a number of plants in each industry. From those three annual series, estimating equations were derived in this general form:

$$\frac{\text{Output}}{\text{Man-hours}} = A + B\left(\frac{\text{Kilowatt Hours}}{\text{Man-hours}}\right) + C \text{ (Man-hours)}$$

It is assumed in this equation that output per man-hour is associated with the volume of electricity used and with the scale of operations of the plants.

In most industries, plants supplying the annual data on which the estimating equations were based account for from one-third to one-half of total New England or Massachusetts manufacturing production. The estimates of annual output were checked against other sources of similar data, in particular, U. S. Survey of Manufactures,



1. A technical memorandum describing methods used in calculation of the indexes will be provided on request. Please direct inquiries to the Research Department, Federal Reserve Bank of Boston.

and Census of Manufactures of the Massachusetts Department of Labor and Industries.

The statistical process of deriving the estimating equations from the annual operating data was as follows: Total man-hours, kilowatt hours, and output were obtained for each industry and these totals transformed into indexes or relatives, with 1950-1952 equalling 100. Next, kilowatt hour to man-hour, and output to man-hour ratios were derived. Estimating equations (as shown above) were then derived by statistical correlation with man-hours and the ratio of kilowatt hours to man-hours taken as the independent variables and the ratio of output to man-hours as the dependent variable.

Calculating the Indexes

Output data used in preparing the estimating equations were of two sorts. In six industries, accounting for 42 per cent of New England's manufacturing output in 1953, deflated value of product data were employed. In the remaining industries, undeflated value added by manufacturing data were used.

In four industries, as shown in the accompanying table, work has proceeded to the point where separate indexes for the industries have been tested and adjusted for seasonal variations. Those four industries accounted for 31.5 per cent of the region's manufacturing output in 1953. These indexes are based on deflated value of product data.

In order to prepare an estimate of trends in total manufacturing output, the industry indexes compiled using value added data were deflated for price changes. Using weights derived from the relative position of each industry in its 1950-52 contribution to value created by manufacturing, the separate industry data were totaled to provide a single index for the region. A similar procedure was followed for Massachusetts.

Testing the Indexes

Production indexes for the various industries which resulted from the equations and basic data described above were tested insofar as possible. The estimating equations were rejected if they did not look reasonable with respect to the values of the constants, A, B, and C, derived by statistical correlation. Output as estimated by the equations also had to approximate closely the annual output as shown by data collected from the reporting firms for the five-year period 1950-1954. The predictive strength of the estimating equation was tested by projecting output estimates for a fifth year, using equations based only on four-year data.

The indexes of output based on the methods described were compared with output indexes calculated from the U. S. Bureau of Census data. The Massachusetts index was compared with data collected by the Massachusetts Department of Labor and Industries.

A fourth rough check on the accuracy of the New England indexes was conducted by comparing changes in output per man-hour of New England manufacturing industries with those in the nation. Divergencies were analyzed and additional research was made in cases where unexplained discrepancies were excessive.

In the four industries for which separate data are presented in this report, the United States and New England increases in output per man-hour between 1950 and 1954 were very comparable. The greatest difference was in textiles where the changing structure of the region's industry has had significant effect on its output per man-hour.

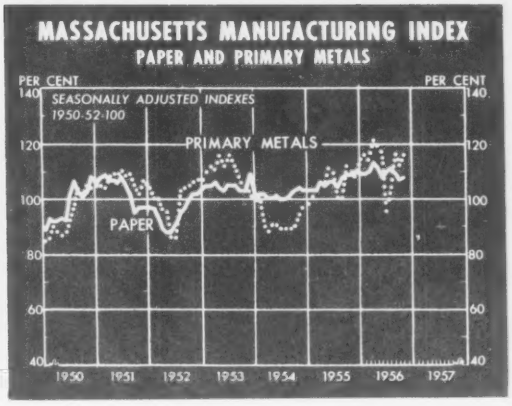
Problems and Opportunities

The technique used in estimating manufacturing output described here has a distinct advantage in relying on only two types of comprehensive data. Ideally, the data collection processes can be uniform in each state and proceed simultaneously. If all the suppliers of monthly data hold to the planned schedule, all the information needed to calculate the indexes should arrive at the Federal Reserve Bank twenty-five days after the end of each month. Calculation of the estimates thereafter can be accomplished very quickly. This provides an opportunity to have monthly manufacturing output estimates published within thirty days of the close of the month.

There are difficult problems involved in translating this ideal process into reality. Perseverance and continued whole-hearted support by all participants will be necessary to carry this program through this introductory period until the index routines become firmly established.

Conclusions

Any technique devised to estimate trends in an activity as complex and volatile as industrial production can claim only a modest degree of accuracy. These indexes are presented for public use with the thought that their immediate availability will build up their use and develop additional interest in further effort along these lines. Continued work by the research staff of the Federal Reserve Bank and by Professor Ernst at Tufts University should result in further improvement and refinement. In this sense, these data should be considered as preliminary and subject to revision.



MASSACHUSETTS MANUFACTURING INDEX

Federal Reserve Bank of Boston Index Seasonally Adjusted 1950–52 = 100

ALL MANUFACTURING
Yearly Averages

1950	1951	1952	1953	1954
96	101	104	111	100

Monthly

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1955	103	104	103	106	108	109	110	105	112	116	114	113	109
1956	114	111	112	116	114	116	117	111	111	112	113		

TEXTILES

1950	109	103	109	111	112	110	112	112	122	122	123	118	114
1951	117	124	112	117	111	107	95	83	90	84	84	85	101
1952	81	76	71	71	74	76	78	88	89	92	95	90	82
1953	87	87	89	88	92	88	90	84	78	73	69	67	83
1954	66	65	67	66	68	70	67	66	57	65	70	61	66
1955	65	68	66	62	60	61	69	66	68	69	72	71	66
1956	72	69	72	72	67	64	53	58	57	60	60		

LEATHER

1950	90	99	95	101	94	95	103	111	121	112	110	111	103
1951	109	112	109	105	92	93	96	92	96	82	87	93	97
1952	90	95	96	96	97	99	101	109	111	101	102	108	100
1953	109	111	108	112	117	109	104	112	104	101	106	101	108
1954	102	94	99	97	104	102	108	98	96	110	107	109	102
1955	109	104	120	116	111	114	117	99	119	123	129	115	115
1956	115	117	118	113	113	114	117	111	106	100	115		

PAPER

1950	89	93	92	92	93	92	101	107	102	101	103	108	98
1951	106	108	109	107	107	106	108	106	102	95	97	97	104
1952	97	96	93	89	88	88	91	95	97	100	102	102	95
1953	104	105	105	106	104	103	105	105	105	103	103	99	104
1954	100	102	102	100	100	101	100	100	101	103	104	103	101
1955	103	103	103	106	105	106	106	104	108	109	109	110	106
1956	109	109	110	113	111	108	109	111	109	107	108		

PRIMARY METALS

1950	85	86	90	88	87	88	94	98	104	100	105	104	94
1951	105	105	104	108	109	109	110	108	109	105	102	107	107
1952	104	100	100	96	95	86	86	103	104	105	106	107	99
1953	107	110	112	111	116	112	116	114	110	106	105	101	110
1954	100	99	90	88	91	91	89	89	89	90	94	97	92
1955	98	101	103	106	106	111	109	100	100	112	110	108	105
1956	114	116	114	121	119	117	95	104	116	112	116		

NEW ENGLAND MANUFACTURING INDEX

Federal Reserve Bank of Boston Index Seasonally Adjusted 1950–52 = 100

ALL MANUFACTURING
Yearly Averages

1950	1951	1952	1953	1954
94	101	106	115	103

Monthly

Year	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average
1955	106	105	107	110	111	112	116	108	112	115	116	117	111
1956	118	118	116	125	119	121	121	117	117	116	117		
TEXTILES													
1950	100	103	101	106	103	102	108	107	114	112	110	112	107
1951	111	115	109	113	107	106	97	88	95	86	84	92	100
1952	87	86	87	83	86	87	90	98	96	95	102	98	91
1953	97	97	97	98	99	98	92	95	90	86	83	79	93
1954	80	78	77	78	83	81	80	79	71	80	82	77	79
1955	83	79	82	80	75	76	83	79	81	84	86	85	81
1956	86	87	87	90	83	83	78	77	75	77	76		
LEATHER													
1950	89	95	94	98	90	91	103	109	119	113	105	104	101
1951	105	107	105	99	89	91	94	90	94	88	82	92	95
1952	93	96	100	102	103	103	104	111	110	107	110	111	104
1953	110	108	111	111	114	108	105	107	101	98	100	100	106
1954	100	101	93	96	99	100	106	100	97	105	107	107	101
1955	108	103	119	109	111	113	114	105	117	121	124	119	114
1956	117	118	107	118	114	111	115	110	104	109	112		
PAPER													
1950	89	87	87	90	88	91	95	98	97	96	97	106	93
1951	94	98	104	103	101	103	103	99	102	94	95	97	99
1952	98	96	96	94	92	93	95	97	99	100	101	103	97
1953	102	103	104	102	104	103	102	107	104	104	105	99	103
1954	102	103	102	101	103	104	101	103	102	106	107	105	103
1955	108	108	108	111	111	112	115	110	112	115	115	117	112
1956	119	119	119	126	122	121	123	121	117	115	118		
PRIMARY METALS													
1950	79	79	86	89	89	93	104	107	106	103	104	105	95
1951	104	102	107	110	107	109	107	112	111	104	100	107	107
1952	105	101	101	90	93	79	65	85	91	96	101	102	92
1953	103	103	106	104	109	108	103	110	112	101	96	89	104
1954	85	82	78	76	81	82	90	85	82	89	90	90	84
1955	92	97	99	100	106	105	97	84	88	102	108	109	99
1956	115	113	103	125	117	107	96	103	109	108	104		